the victor's crown. We recall to mind, at this point, the distinguished Grecian philosopher, Socrates, surrounded by his weeping friends and pupils, whom he was reproving for their sorrow, and endeavoring to console with his own joyful hopes for the future world as he was bidding them farewell; and we can thus think of our Christian philosopher addressing us, from the glory he has attained, in words used by himself, many years ago, in some reflections on the Transfiguration: "Why do we think of the parting pressure of the hand, the last words of love, the dying moan, and not of the crown, the communion with Christ, their eternal repose, and our re-union with them? Why, with desolate hearts, will we continue to stretch our hands to the home of their rest and cry, come, come to our arms? Blessed be God, that he will not hear our prayers. Blessed are the departed, that we cannot recall them from their joy, or wound their hearts by the knowledge that we are willing to disturb their bliss. No, it is not good to be here; we know not what we say."

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*Fourth Contribution to the History of the Permian Formation of Texas. By E. D. Cope.**

(*Read before the American Philosophical Society, March 16, 1883.*)

PISCES.

ECTOSTEORHACHIS CICERONIUS, sp. nov.

The genus *Ectosteorhachis* Cope, is known up to the present time from ichthyolites, which do not exhibit the interior details of the structure of the skull. Several portions of crania having recently come into my hands, I am able to add some important features, and a new species, which I name as above.

The base of the skull consists of ossified parachordals, which embrace the chorda dorsalis posteriorly and are continued for a short distance posteriorly as a tube. Anteriorly the chordal groove is open. Trabeculæ not ossified. The cranial structure is an excellent illustration of a permanent embryonic type. Above and in front of the opening for the chorda, the neural canal enters the groove. The parachordals are subtriangular, presenting one angle forwards, and having the internal side that bounds the groove straight and longitudinally grooved. The anteroexternal side is oblique and nearly straight, and is overhung by the osseous roof of the skull. These characters are identical in both species.

The *E. ciceronius* differs from the *E. nitidus* in having a narrower interorbital region, and in the possession of small tubercles of ganoïne on the posterior parts of the superior surface of the skull. These are seen on the sides of the surface, and are quite small, not numerous, and

*The third contribution can be found at page 447 Proceedings of the Society for 1882.

of various sizes and shapes. They resemble shining seeds. In *E. nitidus* these points are wanting, but there are rugosities on the postfrontal and pterotic regions of a radiating character, not found in *E. ciceronius*.

Measurements.	M.
No. 1.	
Length of skull to occiput above (muzzle worn)	.069
Interorbital width	.014
No. 2.	
Length of osseous base of cranium (parachordal)	.039
" open median groove	.022
Width of base at parachordals	.036
" groove at apices of parachordals	.011
" foramen notochordæ	.0095

Found by Mr. W. F. Cummins.

GNATHORHIZA SERRATA, gen. et sp. nov.

This presumed fish is represented by some teeth which are processes of osseous bodies, which may be roots properly so called, or may be jaws. The osseous bases are shallow, and thickened on the free edge, which is directed obliquely away from the plane of the crown of the teeth. The teeth obtained are flat, and doubtless bilaterally symmetrical, though no complete pairs are preserved. The largest of these has a curved edge, and a branch extending posteriorly at right angles to it, joining it at a point at one side of its middle. The longer (and more curved) part of the convex edge, has two coarse angles; the shorter part is finely denticulated, as is the transverse lamina. The principal edge is worn posteriorly by use. The external convex face is marked by coarse and finer lines of growth, like those on corneous processes. A second form of tooth is not curved, but flat, so far as preserved. It has three coarse obtuse teeth. Two other toothed bodies resemble it. All the teeth are covered with brilliant ganoïne on both sides.

Measurements.	M.
Length of chord of larger tooth	.010
" cross lamina	.0055
Elevation of principal edge	.006
" with root	.008
Thickness of root at base	.002

The genus *Gnathorhiza* may belong to the Petalodont family, though I think it very doubtful. The characters of the roots of the teeth are more like those of sharks.

BATRACHIA.

TRIMERORHACHIS BILOBATUS, sp. nov.

Among the many specimens of animals of this genus which have passed through my hands, I have not until now been able to select more than one

species, the *T. insignis*. Mr. Cummins, however, now sends me parts of skeletons of four individuals, which present distinctive characters. Two of these include vertebral elements, and all embrace jaws and bones of the limbs and arches.

The vertebræ present no important difference from those of *T. insignis*, but the surface of the intercentrum is not yet cleaned of a thin layer of matrix. The peculiar character of this species is most readily seen in the posterior portions of the mandibular ramus. The angle consists of two subequal tuberosities which are separated by a deep groove, instead of one prominent one. The external tuberosity is represented in the *T. insignis* by a small protuberance of the lateral enlargement of the external face of the ramus. The extremity of this tuberosity is in the *T. bilobatus* strongly honeycombed, and it is bounded below and externally by a groove which is faintly indicated in *T. insignis*. Above it, on the inner side, is another, shallow groove, from which it is separated by a sharp ridge. Both grooves are smooth. The superior one is wanting in *T. insignis*. The quadrate cotylus is more depressed externally than in *T. insignis*, thus making it more oblique. The internal fossa of the cotylus is not divided by a longitudinal groove, as it is in *T. insignis* The dental foramen is large, and is located as in the *T. insignis*. There is also an inferior longitudinal groove of the ramus as in that species. The surfaces preserved show that the sculpture is more marked in the *T. bilobatus* than in the *T. insignis*.

Measurements.	M.
Depth of ramus at interior edge cotylus	.026
Length " from " " "	.020
Width " at " " "	.017
" of both tuberosities of angle	.0125
Diameters of intercentrum { anteroposterior	.011
Diameters of intercentrum { transverse	.021
Thickness of intercentrum	.004

The specimens described came from the same locality, and a different one from that which has produced the specimens of the *T. insignis* (Type No. 39, 1882).

REPTILIA.

Pariotichus megalops, sp. nov.

This reptile is known to me from a nearly complete, somewhat distorted cranium. A thin layer of matrix conceals the greater number of the teeth, so that the presence of canines cannot be demonstrated. Those which are visible are on the premaxillary and anterior parts of the maxillary bones. They are small, conic, slightly curved, acute and absolutely smooth.

The muzzle is short and broadly rounded. The nareal opening is latero-superior, and is just above the principal convexity where the lores pass into the muzzle. Canthus nostralis rounded off. Interorbital region wide, convex in section, nearly plane anteroposteriorly, its width a little exceeding the diameter of the orbit. Orbit large and round, its diameter equal to

the length of the muzzle in front of it, obliquely measured, and one-half the distance from its posterior edge to that of the temporal roof (? squamosal bone). Posterior outline of skull above, truncate, surface slightly convex transversely.

The premaxillary spines are short and wide, the nasals are also short and wide. The prefrontals and postfrontals form the superior edge of the orbit, excluding the frontals. The intercalaria (or ? pterotics) are very large; at the externoposterior angle is a very small element in contact with the supraoccipital which may be the true intercalare. The supraoccipitals have considerable transverse extent, running out externally in narrow apices. All the bones of the cranium are sculptured in honeycomb fashion, the ridges radiating on some of the bones. That is, on the posterior parts of the frontals and parietals and anterior part of the intercalare and squamosal. A groove follows the edge of the orbit, and turns inwards on the prefrontal bone, forming a rudimental lyra. External surface of mandible grooved below; superior part concealed.

Measurements.	M.
Width of skull between posterior angles	.018
Interorbital width	.008
Axial length of skull	.024
" from muzzle to between centres of orbits	.0096
Width of muzzle at nares	.0095
Length from orbit to nostril	.0035
Depth of skull posteriorly, to mandible	.010

The superior part of the posterior region of the inner face of the dentary bone supports a patch of small obtuse teeth, which narrows forwards into the single row of the edge of the ramus. This patch is no doubt homologous with that which is so largely developed in *Pantylus*.

The surface of the cranium has been mostly weathered away in the type of *Pariotichus, P. brachyops*, and I suspect that it is really sculptured and not smooth, as I originally stated. The *P. megalops* differs from the *P. brachyops* in the larger orbit, the narrower interorbital space, and the smaller and more numerous teeth.

Pariotichus and *Pantylus* and probably *Ectocynodon* must be referred to a special family, the *Pariotichidæ*, which has teeth like the *Edaphosauridæ** but differs from it in the entire overroofing of the temporal fossæ.

Chilonyx rapidens Cope, gen. nov.

Char. Gen.—Teeth with the long diameter of the crowns transverse to that of the jaws, and with the crown contracting to a single slightly incurved apex. Maxillary series of teeth short. Temporal fossæ overroofed. Superior surface of cranium divided into more or less swollen area by grooves.

The characters above enumerated indicate for this genus a position near the *Diadectidæ*. From these it differs in the form of the teeth, and the

* Proceed. Amer. Philos. Soc., 1882, p. 450.

short and narrow maxillary bone. Two ilia accompanying the cranium have the form of those of the *Clepsydropidæ*, and differ entirely from those of the *Diadectidæ*. On the other hand, the *foramen magnum* is wide, and the exoccipitals present two articular facets downwards as in the latter family. It is possible that the genus should be referred to the *Bolosauridæ*, which is in dentition intermediate between the *Clepsydropidæ* and *Diadectidæ*.

A femur, which is included in the lot of specimens, has a wide head without trochanters, convex in the plane of the distal condyles and flat in the direction at right angles to it. There is a huge trochanteric fossa extending from the head two-fifths the length to the condyles, bordered by a ridge on each side. The condyles present in the same direction as the fossa posteriorly. They are separated by a deep anterior and posterior emargination. Their anterior edges overhang the condylar articular surfaces, making acute angles with them. One of the articular surfaces is smaller, is anteroposteriorly extended, and has a convex ectad, and concave entad border. The other surface is also anteroposterior, reaching further distad, but not so far proximad as the other. Its area is greater than that of the other, and it is deeply notched by the entering surface of the bone ectad and proximad. It is then contracted into a wide isthmus, and the lateral grooves which produce this isthmus are overhung by the expansion of the anterior face. The anterior face of the femur is without ridges or processes.

The condition of the specimen is such that the composition of the skull may be readily made out. The postfrontal bones are large, and form the superior border of the orbit. At the front of the orbit they reach the prefontal, thus excluding the frontal. The parietal bones are wider than the frontals, and are bounded laterally by the postfrontals and the squamosals and by an element between the squamosal and exoccipital, which occupies the position of the *intercalare* of the *Stegocephali*. Below this bone, on the inner side of the suspensorium, is the probable proötic. The squamosal, or an element which I cannot distinguish from that bone, extends to the condyle of the quadrate, concealing that bone from view from externally. The quadrate is short, and thins out rapidly upwards, being closely united with the squamosal. Its condyle is set at an angle of 45° with the axes of the skull, and consists of one flat and one convex surfaces, continuous but forming a deep angle together. Exterior to the exoccipital, and interno-inferior to the intercalare, is a small distinct element, apparently in the position of an opisthotic or external occipital.

The excavation for the auditory apparatus appears to be in the exoccipital. It is almost entirely filled by what I suppose to be a large stapes. This bone is in shape like a compressed flask, with the head directed inwards and forwards, and its inferior edge produced into a prominent keel, which is produced into a point below, and free from the neck of the flask. The head is truncate, and is separated from the internal cranial wall by a narrow interspace. Its external extremity is not absolutely perfect in the specimen, but does not appear to have extended in an ossified condition be-

yond the exoccipital bone. In a specimen of *Empedias molaris** there is a meatus auditorius, in which the stapes was not found on cleaning out. This element is coösified with the surrounding bones laterally and posteriorly. Consequently when broken open, the vestibule is represented by two deep grooves, directed inwards and anteriorly.

The single species of this genus is one of the largest saurians yet obtained from the Permian of North America.

Char. specif. The superior surface of the skull is everywhere flat, as is the external face of the maxillary. The surface of the latter is marked by moderately coarse fossæ and grooves, separated by more or less fine irregular but generally longitudinal ridges. The minute sculpture of the superior cranial surface, is finer and more punctate in character. The areæ of this surface, already mentioned, are arranged as follows: There is a series over the orbits, which are separated from each other by straight grooves, and which grow larger and more swollen posteriorly. Between these supraorbital rows, the areæ of the top of the skull are separated by longitudinal grooves, except immediately between the widths of the orbits, where there are some narrow transverse areæ. On the supraoccipital region there is a median subtriangular area, and three narrow longitudinal ones on each side of it. External to these, and on the posterior part of the squamosal region, the areæ are larger and more swollen. A cluster of three of these lies between the exoccipital bone, and the smooth descending surface of the posterior edge of the squamosal. Of these the one bounding the exoccipital bone, is a robust cone, forming a short horn, like that occupying a similar place in the horned toad, *Phrynosoma douglassi*. Between the temporal areæ, and in front of the supraoccipital areæ, on each side of the middle line, there are three longitudinal areæ, which are successively narrower externally, the exterior being very narrow. On the frontal region anterior to the transverse areæ, are two wide longitudinal areæ. Each nasal bone has a small median area, from which radiate grooves, of which some of the posterior are close together.

The occiput is excavated into a large fossa on each side of a large triangular supraoccipital region. The fossæ are bounded externally by a strong exoccipital crest and at the anteroinferior corner by the "opisthotic." This bone projects posteriorly and downwards, in the form of a robust hook. The foramen magnum is not excavated so abruptly above the exoccipital facets as in *Empedias molaris*.

Measurements of Skull and Femur.	M.
Interorbital width	.108
Length from supraoccipital crest to frontonasal suture	.135
Width between apices of tuberosities of the intercalaria	.113
Length from apex of tuberosities to inferior extremity of quadrate	.129

* Figured in the Proceed. Amer. Philos. Soc. xix. p. 56.

Measurements of Skull and Femur.		M.
Diameters of quadrate condyle	anteroposterior	.020
	transverse	.039
Length of maxillary on alveolar edge		.087
Diameters base of a posterior tooth	anteroposterior	.007
	transverse	.010
" of base of another posterior tooth	anteroposterior	.005
	transverse	.010
Length of femur		.236
Proximal diameters of femur	anteroposterior	.047
	transverse	.085
Width of shaft		.052
" distally (greatest)		.115

EMPEDIAS FISSUS, sp. nov.

The species of *Empedias* form a series which diverges from *Diadectes* in a successive widening of the crowns of the teeth and diminution in their number. Thus the *D. phascolinus* is nearest to *Diadectes; D. molaris* succeeds it, and in *E. fissus* we have the molariform character most strongly developed. In the *E. latibuccatus*, on the other hand, the diminution of the transverse extent of many of the teeth and the areolar sculpture of the superior surface of the cranium points in the direction of the genus *Chilonyx*. The species of *Empedias* may be easily distinguished as follows:

I. Surface of skull divided by grooves into areæ.

Superior teeth, 16 on each side, a number on each end of the maxillary bone of little transverse extent.....*E. latibuccatus.*

II. Surface of skull uniformly rugose.

Superior teeth narrower, 16 on each side, the last one small, sphenoid flat, pterygoids narrow.....*E. phaseolinus.*

Superior teeth wider, 14 on each side, the last one smaller, sphenoid keeled medially, pterygoids wide.....*E. molaris.*

Superior teeth wider, 14 on each side, the last the largest, sphenoid not keeled.....*E. fissus.*

Of the *E. latibuccatus* I have two specimens with teeth, one including a large part of the cranium and lower jaw. Of the *E. phaseolinus* I have five specimens with teeth, one of which embraces a nearly complete skull and a large part of the skeleton. Of the *E. molaris* I have also five individuals, of which three are crania. The *E. fissus* is represented by two individuals. One of these is one side of the entire upper jaw; the other is a broken skull with the four series of molar teeth. Of other parts of the skeleton, not identified as to species, I have a large number.

The *Empedias fissus* is nearest the *E. molaris*, and has the same number of teeth. It differs, however, in various essential points. The last maxillary tooth, which is much reduced in size in the *E. molaris*, is here as large as any of the others. The portion of the crown within the medium cusp is fissured medially in the direction of its length; that is, transversely

to the axis of the jaws. This fissure is not so distinct in the mandibular teeth. The median cusp has a straight edge at right angles to the long axis of the crown. The specimen where the entire dental series of one side is preserved, shows that the latter has a sigmoid flexure, the middle of the maxillary bone being incurved, and the anterior part convex outwards. There are five or six conic teeth between the incisors and the molars.

The inferior surface of the sphenoid bone is medially flat in transverse section, and concave anteroposteriorly, in this resembling *E. phaseolinus* rather than *E. molaris*. The upper jaw specimen shows that the muzzle projects beyond the incisor teeth, which is not the case in *E. phaseolinus*, which has the incisors very prominent. The supraorbital border is regularly convex, and not depressed and notched as in *E. phaseolinus* and *E. latibuccatus*. The superior surface of the skull is marked with innumerable small impressed pits, and assumes a spongy appearance above the orbits.

Measurements.

		No. 1. M.
Length of last six superior molars		.055
Diameters of antepenult molar	anteroposterior	.010
	transverse	.020
Diameters of crown of incisor	vertical	.013
	transverse (at base)	.007
	anteroposterior	.011

No. 2.

Length of dental series in a straight line	.093
Width of palate at anterior expanse	.062
" " contraction	.068
" " between widest molars	.036

Discovered by Mr. W. F. Cummins.

EMPEDIAS PHASEOLINUS Cope, Proceeds. American Philosoph. Society, May, 1880 (*Diadectes*).

The fine specimen of this species above mentioned, which was obtained by Mr. Cummins, includes some parts of the skeleton not or rarely found hitherto. The pelvis shows that the corresponding part described by me, Proceedings of the American Philosophical Society, 1882, p. 448, belongs to another species of this group. The clavicles are preserved, and enable me to identify the corresponding part of another species in which the structure is more distinctly visible. This shows an episternum wedged in between the adjacent extremities of the clavicles, which are here very robust. But a small part of it appears in the inferior surface, but superiorly it forms a plate which covers the symphysis of the clavicles, but does not extend posterior to them. The suture of the episternum with the clavicles below is a coarse interdigitation. Posterior to it is the symphysis of the clavicles.

The skull of this specimen is the first that I have seen in this group which possesses a basioccipital bone and condyle. This proves that in the five other crania of allied species, it has fallen out, which indicates its very

weak attachment to the sphenoid. The lateral superior articular facets of the exoccipital bone are characteristic of the family, and of the genus *Chilonyx*. This skull also shows that the premaxillary bones may be distinct, and that they extend but a short distance on the superior face of the muzzle.

In this species the interorbital region is wide and concave, and the parietal regions are swollen and convex. The supraorbital border is nearly straight, and has an open notch medially.

The hyposphen varies in size in different parts of the vertebral column, and is generally very large. The neural spines have bilobate extremities.

Stated Meeting, Jan. 5, 1883.

Present, 8 members.

President, Mr. FRALEY, in the Chair.

The resignations of A. E. Outerbridge, Jr., dated May 15, 1882; of B. B. Comegys, dated Nov. 1 1882; of Alfred Stillé, dated Dec. 28, 1883; and of Horatio C. Wood, dated Jan. 3, 1883, were announced by the Treasurer, and on motion accepted.

The death of John Forsyth Meigs, M.D., at Philadelphia, Dec. 17, 1882, aged 65, was announced.

The death of the Rev'd Charles P. Krauth, D.D., Vice-Provost of the University, at Philadelphia, Jan. 2, 1883, aged 59, was announced. The President was authorized to provide for obituary notices of the deceased.

Donations for the Library were reported from the Geographical Societies at Munich, Bordeaux and Paris; the Meteorological and Astronomical Societies in London; the Society at Riga; the American Society at Paris; the Peabody Fund and the Museum of Comparative Zoölogy at Cambridge; the Boston Zoological and Natural History Societies; American Journal of Science; American Academy of Medicine; N. Y. Academy of Science; Franklin Institute;